



US011064904B2

(12) **United States Patent**
Kay et al.

(10) **Patent No.:** **US 11,064,904 B2**

(45) **Date of Patent:** **Jul. 20, 2021**

(54) **SMART DRILL, JIG, AND METHOD OF ORTHOPEDIC SURGERY**

(71) Applicant: **EXTREMITY DEVELOPMENT COMPANY, LLC**, Akron, OH (US)

(72) Inventors: **David B. Kay**, Akron, OH (US); **Ian P. Kay**, Fairlawn, OH (US); **Dustin Ducharme**, Littleton, CO (US)

(73) Assignee: **EXTREMITY DEVELOPMENT COMPANY, LLC**, Akron, OH (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 386 days.

(21) Appl. No.: **15/445,311**

(22) Filed: **Feb. 28, 2017**

(65) **Prior Publication Data**

US 2017/0245781 A1 Aug. 31, 2017

Related U.S. Application Data

(60) Provisional application No. 62/301,257, filed on Feb. 29, 2016, provisional application No. 62/358,739, filed on Jul. 6, 2016.

(51) **Int. Cl.**

A61B 34/20 (2016.01)

A61B 34/00 (2016.01)

(Continued)

(52) **U.S. Cl.**

CPC **A61B 5/062** (2013.01); **A61B 5/067** (2013.01); **A61B 5/1121** (2013.01);
(Continued)

(58) **Field of Classification Search**

CPC A61B 2034/2072; A61B 2560/0223; A61B 2562/0219; A61B 34/20; A61B 5/062;
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,230,338 A 7/1993 Allen et al.
5,230,623 A 7/1993 Guthrie et al.

(Continued)

FOREIGN PATENT DOCUMENTS

CA 2570336 C 1/2013
CN 104271046 A 1/2015

(Continued)

OTHER PUBLICATIONS

Mendes et al., Ethylene oxide sterilization of medical devices: A review, Nov. 2007 (Year: 2007).*

(Continued)

Primary Examiner — Luther Behringer

Assistant Examiner — Farouk A Bruce

(74) *Attorney, Agent, or Firm* — Hudak, Shunk & Farine Co. LPA

(57) **ABSTRACT**

The present invention provides a MEMS sensor guidance system mounted on a surgical instrument and uses the MEMS sensor to determine Inertial Measurement Units to track rotation and acceleration in all three spatial directions. Further the invention provides a method of surgery in which a reference axis, a loci, and a depth are defined and the instrument including the sensor cluster of the invention is placed in relation to the y-axis and x-axis and following the working end is aligned and the orientation and depth data display is observed to aid in maintaining the desired instrument.

31 Claims, 10 Drawing Sheets

